Regions and cities

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4 NATIONAL EFFICIENCY AND SPATIAL DISPERSION

4.1 Introduction

In the 1990's a main shift in Dutch economic policy has been the decline of the importance of unemployment issues and a sharp increase of spatial scarcity problems. By the end of the 1980’s, for the first time in history the fact that the Netherlands is one of the most densely populated countries in the world was starting to be considered an impediment to economic growth, in particular when it comes to congestion costs (Sijtsma et al., 1996). Today, the Dutch regional economics profession is no longer asked to analyse less developed regions and to come up with policy proposals to improve their economic development. Instead, the focus is now on the large agglomerations that have always been the main centres of economic growth, but are now increasingly confronted with serious diseconomies of scale and concentration (see figure 4.1 – 4.2). In the 1990’s traffic congestion has started to spread outside the Rim City further into the South and the East of the country moving rapidly to a situation where the Northern regions of the Netherlands are one of the few regions left without congestion problems. Other spatial scarcity issues are a lack of space for industrial sites and new residential areas, and serious implementation problems for precisely the additional infrastructure that is badly needed: new roads and railways schemes are more in conflict with other spatial claims than ever before (EZ, 1995; Oosterhaven, 1996).

Figure 4.1 Northern Netherlands versus the Rim City; population density 1993.

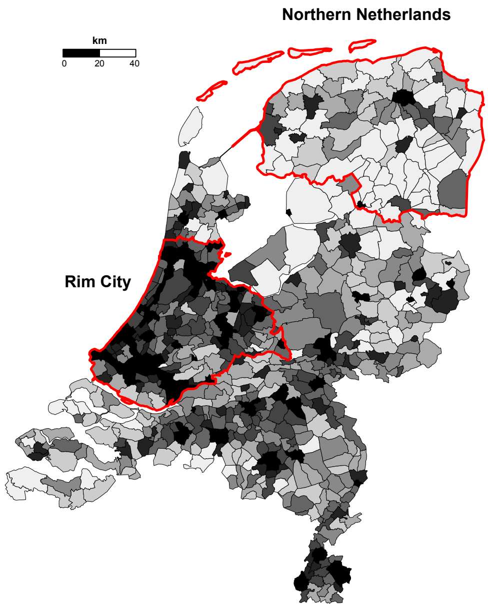
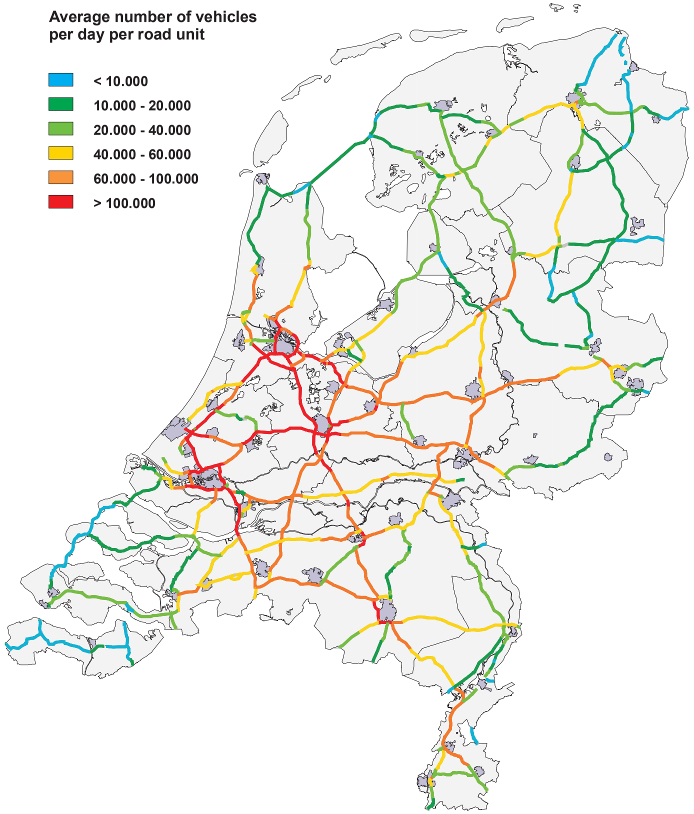


Figure 4.2 Traffic indicators

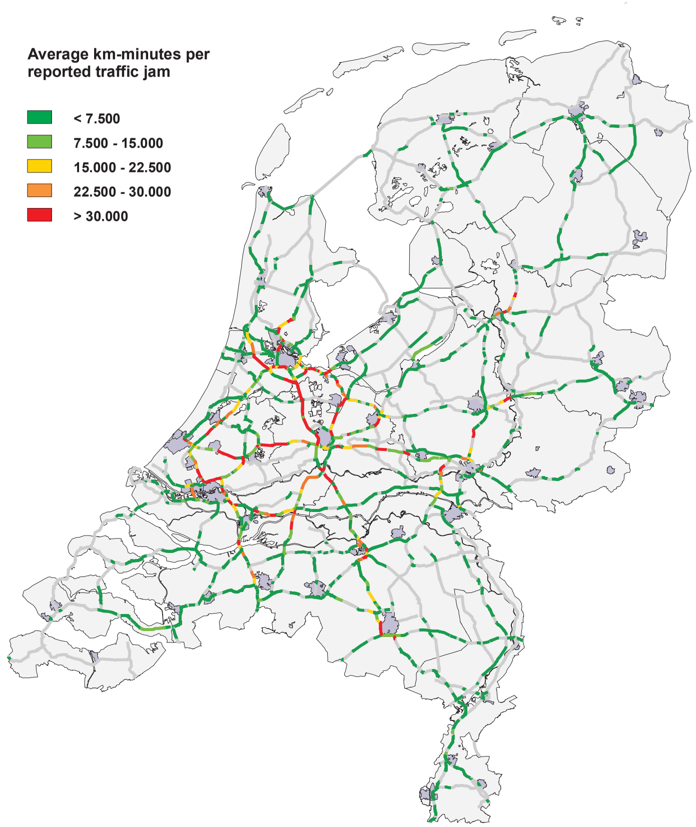
A. Traffic intensity 2000



Average number of vehicles per day per road unit

- < 10.000
- 10.000 - 20.000
- 20.000 - 40.000
- 40.000 - 60.000
- 60.000 - 100.000
- > 100.000

B. Congestion 2000



Average km-minutes per reported traffic jam

- < 7.500
- 7.500 - 15.000
- 15.000 - 22.500
- 22.500 - 30.000
- > 30.000

Due to growing congestion, higher infrastructure costs, soaring housing prices, and deteriorating urban environments, locational costs are changing to the advantage of the regions outside the urban core helping them to catch up with that urban core. According to several studies (Fothergill *et al.* 1986, Clark 1989, pp.23-25, Marshall & Wood 1995, Boeckhout & Haverkate 1995), these factors contribute to a flow of industry away from central regions, but up to now mostly towards the periphery of the urban core and not towards the periphery of the country under study.

This is also true in the perception of Dutch spatial policy makers. Although the political agenda is becoming increasingly occupied with issues of congestion and spatial scarcity, surprisingly all national policies options under discussion are suffering from myopia with respect to the spatial opportunities of the northern regions. Despite the fact that the North is a 1½ hour drive from the main economic centres in the Rim City – note the scale of Figure 4.1 - all policy options are focussed on the Rim City itself and the possible benefits of a spreading of population and employment to the North is not considered. Some options even show a revival of the old Dutch solution of taking land from the sea: several residential and industrial site projects in the vicinity of The Hague and Rotterdam on new islands to be created in the North Sea are seriously being discussed, around Amsterdam such projects are already under construction in the IJsselmeer.

The surrealistic option of making new islands while space is abundant in the northern backyard may have triggered our initiative in 1995 of setting up a comprehensive social cost-benefit analysis of a substantial exogenous shift in regional population and employment in the Netherlands. The question was: does it pay to redistribute economic activity more evenly over regions? From the literature, there are monographs available on sub urbanisation and the creation of suburbia[22], but no single study had yet tried to measure the net total of all potential efficiency gains and losses of a (de)concentration scenario. It was the purpose of this study to take account of all social cost and benefits of the concentration or dispersion of people and economic activities between different regions within one comprehensive framework.

The basic idea was to simulate two long term scenarios of regional development, one without, and one including a large shift of people and jobs from the Rim City towards the northern provinces, assumed to take place over a period of 20 years. Our first intuitive idea was that regional overcapacity of space and infrastructure in the North would be able to absorb an extra population of 1 million people without considerable problems. By contrast, our feeling was that 1 million less population in the Rim-city would lead to a substantial alleviation of congestion. Later, a more modest shift of 250.000 jobs implying a population shift of about 700.000 people was chosen. A full research description is

[22] See, among others, Law (1988), Kelly (1989), and Clark (1989). The Journal of Regional Science and Urban Economics paid attention to economic models on the interface between urban structure, urbanisation and regional economic growth in a special issue (vol. 26, no. 6, December 1996).

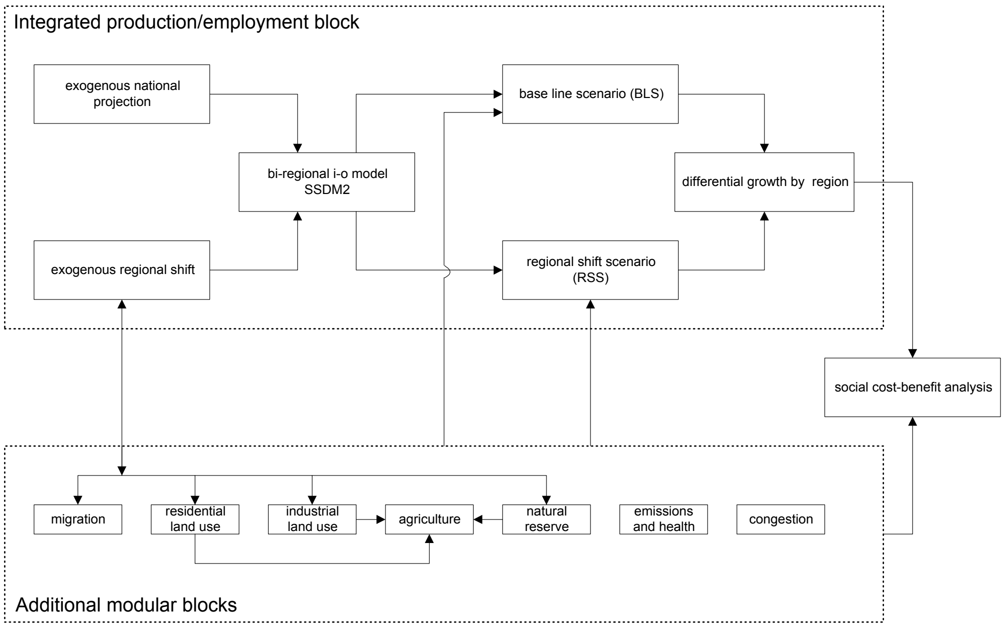
given in Sijtsma et al. (1996), which was presented on a special symposium on the subject (Elhorst, 1996). An English summary was published in Elhorst et al. (1999).

This chapter gives an overview of the Sijtsma et al. (1996) study with the main focus on the technical modelling issues. A revised version of ISAM was used with many elements from SSDM, but within a much larger modelling context and with substantial additional issues of overall model consistency. Section 4.2 and 4.3 give a description of the core model. Sections 4.4 and 4.5 discuss the two long-term scenario's used. Section 4.6 describes the additional model blocks in a larger context. After a discussion of the social cost benefit analysis in section 4.7, the last section 4.8 draws some conclusions.

4.2 General outline of the model

Figure 4.3 shows the general outline of the model used. The core of the model is the upper part labelled as “integrated production/employment block”. In order to provide a benchmark for determining the welfare effects of a spatial deconcentration scenario, first a no-policy baseline scenario (BLS) was projected for the period 1995-2015. Exogenous national projections for production, expenditures and employment were based on the so-called European Renaissance Scenario of the Central Planning Bureau (CPB, 1992). With a biregional input-output model, here labelled “SSDM2”, the national scenario was translated into a regionalized BLS containing production and employment growth by sector and region. As its name SSDM2 indicates, this model block is a modification of the Indonesian SSDM model described in the previous chapter.

Figure 4.3 General outline of the regional shift model



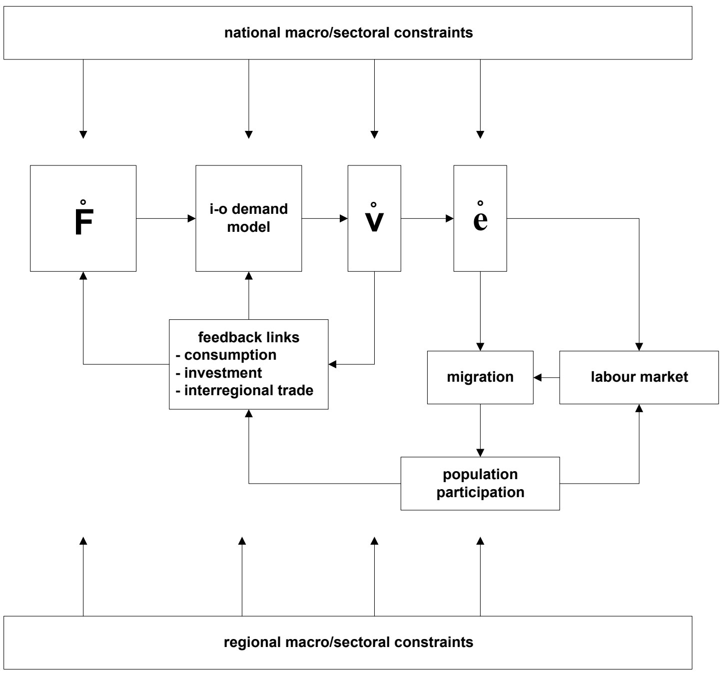
Next, the BLS was run again, but this time added with exogenous regional shift assumptions. A comparison between the resulting Regional Shift Scenario (RSS) and the BLS then gives the differential growth by sector and region over the projection period.

The lower part of figure 4.3 shows separate model blocks for other variables that were considered relevant for the study. They all function more or less as stand-alone modules in the sense that they only provide input for or translate output from the main model without endogenous second order effects. The agriculture block is treated as a residual only. The nature reserve, residential and industrial land use scenarios together lead to a decline of agricultural land use. The resulting differential growth by region and its translation into the variables of the modular blocks is the input for the final cost-benefit analysis of the assumed exogenous regional shift. The different blocks of figure 4.3 are described in the subsequent paragraphs.

4.3 The SSDM2 model

Because of the long-term character of the regional shift study, the Indonesian SSDM model was taken as a starting point. As Figure 4.4 shows, SSDM2 is set up largely in the same way as SSDM (see for a comparison figure 3.2).

Figure 4.4 Structure of SSDM2



The differences are the following:

1) Where the Indonesian SSDM is a 27-region implementation, SSDM2 is set up as a biregional model with the Northern Netherlands (N) and the Rest of the country (ROC) as the only two regions.
2) in SSDM2 there is no endogenous government finance model. Final demand of government consumption and investment is exogenous.
3) The exogenous national projection - and thus the BLS - contains consumption growth that is differentiated by product. The main shift in consumption in the RSS is caused by regional differences in population growth regardless of average income levels. This means that all entries of the matrix **Q** of consumption elasticity's in (3.1) are set to one in the endogenous consumption equation, leaving only regional differences in population growth as a feedback to regional consumption in the next period:

$$\dot{\mathbf{C}}_t \quad = \quad \dot{\mathbf{P}}_{\mathrm{t}} \left(\dot{\mathbf{V}}_{\mathrm{t-1}} / \dot{\mathbf{P}}_{\mathrm{t-1}}\right) \qquad (4.1)$$

4) SSDM2 has an endogenous feedback link into the i-o model itself for interregional trade. The rationale behind this is that in the case of a large regional shift over a longer period of time it is reasonable to assume that the interregional trade coefficients will change. When local supply of sector i in region r increases more than in other regions, it enables local industries to purchase their inputs from sector i more from the local market than from outside the region. In addition, the mirrored case is that industries in ROC may increase their imports of inputs from sector i in region r. The implicit assumption behind this is that imported and locally produced goods can be each others substitutes. This is different from the standard used in most interregional i-o models, which treats goods from the same sector from different regions as different. In practice, however, even in disaggregated i-o models with 30 sectors or more, what is considered as one homogeneous sector i in fact consists of a large number of firms producing a large variety of goods. Substantial regional growth in this sector in general adds to this variety by expanding production to larger bundles of different goods and/or entering of new firms with new products. This indeed increases substitution possibilities for inputs from sector i for local firms. In SSDM2 this relation is modelled with a one-year time lag:

$$\dot{\mathbf{A}}_t \quad = \quad \gamma_{t-1} \cdot \dot{\mathbf{A}}_{t-1} \qquad (4.2)$$

with

γ = (r x i) - vector with trade adjustment coefficients γ_i^r

γ_i^r = $\dot{\mathbf{v}}_i^r / \dot{\mathbf{v}}_i^n$

$\dot{\mathbf{v}}_i^r$ = GDP growth of industry i in region r

$\dot{\mathbf{v}}_i^n$ = national GDP growth of industry i

5) The feedback to the supply side in SSDM2 follows the simple equation (3.21) without regional differentiation of incremental capital/output ratios:

$$\dot{\mathbf{i}}_i^r = \dot{\mathbf{v}}_t^r \qquad (4.3)$$

with

$\dot{\mathbf{i}}^r$ = total private investment growth in region r

$\dot{\mathbf{v}}^r$ = total GDP growth in region r

6) The feedback of employment to migration is set proportionally with an exogenous multiplication factor for the average family size of migrating workers: for each extra job e in region r a number of αe people migrate to the region. For the period 1995-2015 this factor α is set to 2,94 (Sijtsma et al. , 1996 p. 31).

4.4 The Baseline Scenario (BLS)

In order to evaluate a long-term exogenous shift in regional production and employment, a policy-neutral projection of what would be likely to happen without that shift was taken as a benchmark. The problem is comparable with the Indonesian R2 scenario discussed in the previous chapter that was set against the policy-neutral scenario R1. In this case a Baseline Scenario (BLS) was projected for a 20-year period to 2015, based on the then latest national economic long-term projection of the Central Planning Bureau (CPB, 1992).

One may question the need for a long term BLS in this model setting of an exogenous shift. Why not just simulate a regional shift today and calculate production, income and welfare effects immediately? In the Indonesian case of the scenarios R1 and R2, it was clear that the model implementation needed to be a long-term projection of annual growth. First, both scenarios were regionalized versions of the upcoming national 25-year plan and R1 served as an indication of how regions would develop in the absence of a specific regional policy like R2. Second, the national constraints, given by assumptions on export development and macro economic growth, were not uniform over the projection period so each year had to be simulated separately. Finally, the timing of regional divergence and convergence over the period was of specific interest (see figure 3.4).

The choice to model the effects of a regional shift towards the Northern Netherlands in the form of a comparison of two long-term scenarios has a different background that is related to capacity levels. In particular, the modelled effects of the RSS on traffic and traffic congestion largely depend on absolute traffic levels in the BLS: when roads are used close to their maximum capacity, a small change of traffic volume can lead to large congestion effects. One important source of possible welfare gains in the RSS is the current overcapacity of Northern road infrastructure. In a regional shift analysis carried out today, current unused northern road capacity would be used for increasing traffic flows in the North stemming from the regional shift. When the RSS is carried out as a simulation over 25 years, however, some, if not all of this present unused capacity will likely be used up already in the BLS by the end of the period due to autonomous growth of population and mobility. A CBA carried out today, therefore, will not have the correct outcome because the costs of additional northern infrastructure needed in the RSS will be underestimated compared with a CBA for 2015.

The BLS is not presented here in detail. Its philosophy is identical to ISAM and SSDM: it uses final demand growth rates in $\dot{\mathbf{F}}_t$ by sector and region and calculates endogenous growth of production and employment for each year of the projection period. The following assumptions are worth mentioning:

- Regional investment in housing is adjusted to regional differences in population growth.
- On top of the projected national growth rates of exports and private investment by sector, regional macro growth for these expenditure categories is adjusted to the historical regional shift over the period 1987-1992. As mentioned in the ISAM model, for example Northern exports show a structural upward trend compared with national export development.
- For the Rim City itself no i-o table or model was available. Instead, a biregional model for the North versus the rest of the country (ROC) was used. Endogenous results for ROC by sector were applied to the sector structure of the Rim-city resulting in macro growth rates for the Rim City.
- For both regions, North and ROC, national productivity growth rates by sector were taken. The same assumption was made for the development of part-time/full-time ratios by sector.
- The model was run at a detailed level of 38 industries.
- Long-term population projections were exogenously taken from RPD (1996) but corrected upward for the North due to its then recent structural improvement of net migration.
- Regional labour force participation rates were based on 1995 levels and projected with national long term trends by age and sex according to CPB (1992)

Table 4.1 gives the summarized macro results of the BLS. Because the CPB scenario gives a large emphasis on employment growth in services contrary to agriculture and manufacturing, the resulting macro employment growth in the Rim City is slightly below the national average due to the dominant presence of manufacturing in some areas (Rotterdam). Employment growth in the North is substantially lower because of the dominance of both agriculture and manufacturing. With the wisdom of hindsight of today we must state that the annual regional economic outlooks of the most recent years (REV, 1998-2002) show that this was a conservative assumption. Many services sectors in the North have recently grown faster than national and the dominance of agriculture and manufacturing in Northern employment is declining fast (REV, 2002). The BLS outcome of a slight rise of regional unemployment in the North while a decline is projected for the rest of the country is, therefore, too pessimistic. The BLS, however, is not intended as a forecast on its own, but merely as a reference for the RSS.

Table 4.1 Production, employment and unemployment in the BLS 1995-2015

	Rim City	North	Netherlands
Average annual growth %			
Production	2.8	2.2	2.9
Employment	0.8	0.6	0.9
Labour supply	0.80	0.60	0.81
Absolute employment growth (x 1000)	471	72	1169
Total employment 2015 (x 1000)	3199	641	7128
% unemployment 1995	7.5	9.0	7.3
% unemployment 2015	6.1	9.1	5.4

4.5 The Regional Shift Scenario (RSS)

The assumed regional shift from the Rim City (R) to the North (N) consists of a combined exogenous impulse of employment, population and land use.

The employment impulse

For the employment impulse industries were selected that have week ties to R and can be considered to be relatively footloose compared to other industries. This selection is done in a two-step procedure.

First, industries in ROC are selected using interregional and international import and export ratios from the biregional i-o table (Eding et al. 1995). In table 4.2 column B shows the % of total sales of companies in ROC that is exported out of ROC. This indicates the degree to which they do not need to be located in ROC because of their customers.

Next, column C shows their boundedness to local inputs and column D shows the relative size of their foreign inputs, which are assumed to be mainly obtained through mainports like Rotterdam and Amsterdam in ROC. The final estimate of % footloose in column E is found by reducing B with one third of these two contrary indicators: E = B * (1 - C/3 - D/3). The result in E was corrected for some industries by judgement of a panel of external experts and our own common sense (Sijtsma, et al., 1996). One part of this correction was the adjustment of the indicators to specific Rim City levels, because the i-o table, as we already mentioned, in fact gives no trading information for the Rim City itself, but for ROC. Column F shows that these estimates lead to a total pool of 978.000 footloose jobs in the Rim City.

Table 4.2 Estimated footloose % for Rim City industries

	A	B	C	D	E	F
	% foreign exports	% total sales outside Rim City	% input from Rim City	% foreign imports	final estimate % footloose Rim City	total footloose employment
agriculture	71	81	54	11	63	82137
fisheries	89	94	30	33	74	2905
crude petroleum/natural gas	31	89	32	42	0	0
other natural resources	31	80	37	20	0	0
meat products	54	75	52	5	61	2513
dairy products	54	85	63	11	64	3865
fish/vegetables/fruit	43	78	36	44	100	3278
grain industries	43	63	15	74	44	1728
sugar	43	93	51	5	76	703
flower	43	64	40	24	75	15893
chocolate	43	91	29	59	20	576
other food industries	43	90	33	60	50	6086
drinks	43	77	45	38	100	4639
tobacco	43	79	21	63	100	1950
wool	65	65	0	50	100	19
cotton	65	97	26	58	100	237
tricot/socks	65	92	14	54	100	578
other textiles	65	96	29	58	100	3612
clothing	50	92	17	64	100	3668
leather	75	97	16	58	100	357
wood/furniture	23	62	20	64	80	10611
bulk paper	42	96	19	62	70	272
paper products	11	76	15	56	70	3273
graphic industries	11	57	39	35	43	25277
refineries	48	87	40	78	25	1711
chemical base products	71	93	29	47	80	14560
chemical end products	71	93	26	47	70	14578
rubber	71	95	19	62	90	7451
building materials	24	62	30	41	47	5518
base metal	69	92	21	57	30	5176
metal products	38	65	27	48	80	27621
machines	38	68	30	51	90	25955
electronics	60	88	25	56	90	26515
automobiles	60	90	18	59	80	3055
other transportation products	45	64	32	48	47	13030
other industries	43	87	26	45	66	40155
electricity	0	11	50	30	25	2828
energy	0	2	72	1	0	0
water	0	5	74	12	0	0
construction	0	4	58	22	25	44067
wholesale/retail	9	13	54	26	20	113945
hotels/restaurants	0	4	49	16	10	10856
repair	0	12	29	55	9	3422
sea- and air travel	77	82	29	65	25	9298
other transport	41	70	54	21	53	84815
communication	5	27	49	29	50	24813
banking	1	2	66	16	20	15487
insurance	7	17	55	22	35	17804
real estate	0	5	69	14	0	0
business services	9	14	68	9	30	75036
government/social insurance	1	4	59	20	10	18471
defense	0	0	30	48	50	18538
education	0	2	65	15	25	44181
social services	0	1	58	21	25	46206
health care	0	8	50	30	25	58430
culture/sports/recreation	0	1	65	10	10	7533
other services	4	4	49	24	20	23200
household services	0	0	0	0	0	0
not elsewhere specified	0	62	21	42	49	0
total						978429

In the second round, out of the resulting total "footloose pool" of 978.000 jobs in R four types of economic activities have been selected which were considered to be relatively highly footloose and would have locational advantages in the North relative to the Rim City (see also table 4.3):

1) land-intensive activities such as glass-horticulture and activities that require large environmental buffers (34.000 jobs)
2) activities that generate high transport flows without being tied to the Amsterdam or Rotterdam harbour or Schiphol airport (30.000 jobs)
3) activities that have been shown to be highly mobile in recent years (22.000 jobs), mainly wholesale, retail, banking and business services
4) (semi)public sector activities, especially executive branches of public services, located in R that could equally well be located elsewhere (29.000 jobs). These activities are listed in the last five rows of table 4.3.

As table 4.3 shows, these four categories add up to a total of 115,000 jobs specified by sector, which are assumed as an exogenous shift from R to N at the end of the projection period in 2015. This is implemented in SSDM2 by changing the matrix of final demand growth rates $\dot{\mathbf{F}}_t$ of the BLS into a $\dot{\mathbf{F}}_t^*$ for the RSS. Compared with the BLS, the entries of $\dot{\mathbf{F}}_t^*$ show higher final demand growth in N and the mirrored lower growth in ROC. The translation of the changes in employment growth into final demand growth is done straightforwardly using the labour productivity change by sector in the BLS.

It is important to note here that this simulation does not assume that companies actually *move* from R to N, but that economic growth in the RSS in the long run of 20 years is lower in R and higher in N compared to the BLS. It only assumes that new companies are created more in N than in R and/or that existing companies expand their activities more in N than in R, again, both relative to the BLS.

The population impulse

In addition to the initial employment impulse of 115,000 jobs, an exogenous migration impulse of 87,000 people from the Rim City to the North is assumed. This impulse is the result of assumed exogenous shifts in educational institutions (involving 25,000 students), 25,000 asylum migrants and 37,000 retirements migrants. These populations categories do not have direct geographical ties to R, while the employment effect in the region of their destination is considerable. The population impulse is implemented in SSDM2 through a shift from R to N in $\dot{\mathbf{p}}_t$ and, consequently in $\dot{\mathbf{C}}_t$ in equation (4.1). More details about the population shift estimates are given below when the migration block is discussed.

The land use investment impulse

A third component of the exogenous impulse in the RSS stems from extra government investment programs in tourism/recreation and nature construction that are enabled by using less land for housing and economic activity in the Rim City. Furthermore, it has

Table 4.3 Initial employment impulse and endogenous results of the RSS.

	footloose pool Rim City	North initial impulse	of which land intensive	transport intensive	high footloose	endogenous employment	total differential growth
agriculture	82137	7720	7720	0	0	1111	8831
fisheries	2905	406	0	406	0	105	511
natural resources	0	0	0	0	0	1334	1334
dairy/meat products	6378	865	30	835	0	-217	648
other food products	28263	3749	49	3700	0	4095	7844
drinks/tobacco	6588	866	4	862	0	226	1093
textiles	4446	0	0	0	0	0	0
clothing	3668	0	0	0	0	0	0
leather	357	0	0	0	0	0	0
wood/furniture	10611	1548	807	741	0	-487	1061
paper products	3545	217	0	217	0	-91	126
graphic industries	25277	1544	0	1544	0	-301	1243
refineries	1711	306	112	194	0	252	558
chemical products	36588	6536	2386	4151	0	-312	6225
building materials	5518	1118	300	819	0	-337	782
base metal	5176	271	0	271	0	-58	213
metal products	53575	1446	0	1446	0	686	2132
electronics	26515	0	0	0	0	141	141
transportation products	16085	421	0	421	0	-18	403
other industries	40155	0	0	0	0	48	48
public utilities	2828	25	0	25	0	4189	4213
construction	44067	3795	718	3076	0	16395	20190
wholesale/retail	113945	16555	4480	0	12074	15588	32143
hotels/restaurants	10856	3769	3769	0	0	5820	9589
repair	3422	0	0	0	0	2832	2832
sea- and air travel	9298	1544	1017	527	0	787	2331
other transport	84815	18558	8196	10362	0	3743	22301
communication	24813	3313	2880	433	0	3121	6435
banking	15487	997	12	0	985	2890	3887
insurance	17804	7	7	0	0	1443	1449
real estate	0	5	5	0	0	1223	1229
business services	75036	9577	36	0	9542	13419	22996
government	37009	12300	0	0	12300	2750	15050
education	44181	5600	0	0	5600	1735	7335
health care	58430	1800	0	0	1800	18234	20034
culture/sports/recreation	7533	840	840	0	0	5700	6539
other services	69405	8826	0	0	8826	29427	38253
total	978429	114524	33368	30030	51127	135476	250000
% share		100.0%	29.1%	26.2%	44.6%		

been assumed that extra investment in recreational areas will be made to accommodate the new residential areas in the North. Finally, it has been assumed that the lower land prices and the lower population density in the North will lead to more spacious housing and industrial sites than would have been the case in the Rim City. The implementation in SSDM2 takes the form of a shift from R to N in the government investment column of $\dot{\mathbf{F}}_t^*$. More details are given below with the discussion of the land use block.

Employment results

The last two columns of table 4.3 show the endogenous employment effects from SSDM2 with the RSS and the total effect. The total initial impulse of 115.000 jobs, 87.000 people and the land use investments results in an endogenous indirect employment of 135.000 jobs adding up to the intended total of 250.000 jobs. Because these endogenous results were actually the target of the simulation, SSDM2 was used in an iterative process, finding that impulse that given all feedback mechanisms comes up with the 250.000 jobs intended.

The results show a rather large regional employment multiplier of 250.000/115.000 = 2,17, substantially higher than the more common values of 1,5 to 2,0 from less closed demo-economic models (see e.g. Van Dijk and Oosterhaven 1985). The difference can be explained by two factors. First, additional multiplier effects from endogenous private investment, residential investment, and consumption enlarge the standard input-output effects. Second, apart from the initial employment impulse, also the initial population impulse and the extra government investment programs contribute to the relatively large endogenous employment effects.

4.6 The additional model blocks

4.6.1 Population and migration

For both the BLS and the RSS, a projection of regional population growth until 2015 was taken as a reference (RPD, 1996). The extrapolated migration trends from 1987-1994 used by the RPD have been adjusted upward to the then more recent migration patterns, that indicate less negative, or even positive net migration for the North (REV, 1996). The initial population impulse in the RSS of 87,000 people has been implemented as extra net migration for N, mirrored by less net migration for R.

Following RORO (1995), extra migration of retirement migrants and asylum migrants towards regions outside the Rim City was considered to be a realistic option for the future. At the time of the RSS study, the regional share of asylum migrants in the North was relatively low and, given the expected rise of the number of asylum migrants, a doubling of their ratio to regional population for the RSS was assumed[23]. For the RSS a

[23] At the time of this writing it has become clear that this development is indeed taking place (REV, 2002).

total of 25,000 extra asylum migrants were assumed. This also leads to extra jobs in asylum institutions, which are part of the extra government employment mentioned in table 4.3.

Retirement migration towards the North, with its attractive residential environment and low housing prices relative to other parts of the country, is a trend that already has been traced for some parts of Friesland and especially Drenthe. For the RSS the most attractive areas in N have been selected and assumed to be able to absorb additional retirement migrants up to a population share of ages groups of 55 and older equal to 35%, which was the ratio found in areas that were already popular for incoming retirement migrants. In total this assumption leads to an expected additional retirement population of 37,000 people in the year 2015.

Finally, a national screening of educational institutions showed that about 50% of them mainly serve a regional market, while the other 50% are specialized institutions, for example with only one location serving a national market. In the RSS it is assumed that 25% of them in R could equally well be located in N. This leads to an additional shift of 25.000 students and 5.600 jobs. These jobs are the exogenous employment impulse mentioned under "education" in table 4.3.

The total exogenous shift of 87.000 extra population is small compared to the extra overall population growth in the RSS as a consequence of the total employment shift of 250.000 jobs towards the North. Of this total of 250.000 jobs, 14.000 are expected to be occupied by northern unemployed, which would bring northern unemployment down to the national level of 5,4% in 2015 (see section 4.6.5). This was simply set as a model target implying an endogenous migration of 236.000 workers to the North as a residual. That fact that not all workers will "follow the job" to the North stems from the relative improvement of the Rim City environment and housing market in the RSS (see section 4.6.2).

Table 4.4 Population in the BLS and RSS

x 1000		Rim City	North	Netherlands
Population 1995		5233	1622	15433
Growth 1995-2005				
	BLS	512	182	1634
	RSS	-270	964	1634
Difference (absolute)		-782	782	
Difference (households)		-310	310	
Average annual growth %				
	BLS	0.47	0.53	0,50
	RSS	-0,26	2,36	0,50

The inflow of 236.000 workers in the RSS is accompanied by 459.000 household members, which brings the total endogenous population shift to 695.000 people. Including the exogenous shift of 87.000 the total population shift in the RSS adds up to 782,000 or 310,000 households (table 4.4).

Despite the large population shift towards the North it is worth noting here that by the end of the period in the RSS population density in the North still is 30% of the density in the Rim City.

4.6.2 Land use

As figure 4.3 shows, residential land use, industrial land use, natural reserve and agriculture development are each treated in a separate way. As will be discussed below, agricultural land use is treated as the residual of the other three.

Residential land use

Residential living conditions in the urban core differ quite strongly from those in the rural periphery. Generally, houses in the Rim City are smaller and built on smaller lots, the neighbourhood is less green and the distance to green recreational areas is larger. With the Interprovincial Population Model (Poulos, 1995) an estimation is made of the number of houses needed and their estimated land use in both the BLS and the RSS. Roughly, the land use of residential projects in the North take up about 50% more space than in the Rim City. For the RSS it turns out that 14,000 ha additional space is needed compared with the BLS, while the residential land use in the Rim City was diminished with 9,500 ha.

The calculated differences in land use are applied proportionally to the regional investment expenditures in housing in the $\dot{\mathbf{F}}_t^*$ of the RSS. Due to lower land prices in the North, however, less nominal expenditures are needed for the same number of ha than in the Rim City. Therefore, an exogenous adjustment is made for currently existing regional differences in land prices according to RIGO (1990,1992):

$$\Delta\, ih_r \quad = \quad \Delta\, hlu_r \;\; lp_{\mathrm{r}} \qquad (4.4)$$

with

$\Delta\, ih_r$ = differential investment in housing in region *r* in the RSS
$\Delta\, hlu_r$ = differential residential land use in region *r* in the RSS
lp_{r} = residential land price in region *r*

No adjustment is made for potential regional differences in the costs of residential construction itself. In SSDM2, therefore, in the RSS only a shift in the column of investment in housing is assumed due to the regional shift in acquiring residential land plots and their regional price differences.

Industrial sites

Regional employment by sector is translated into land use in ha by company with sector-specific land use coefficients indicating the number of ha needed per employee (NEI, 1993). The estimate of new industrial sites to be created in both regions in the BLS and the RSS and their investment costs takes account of three sources of additional information:

- the available free capacity of industrial sites in the North
- the average larger size of industrial sites in the North
- lower investment costs of industrial sites in the North

For both the BLS and the RSS the following calculation was made for investment in industrial sites:

$$iis_r = \left(\Sigma_i \, \Delta\, e_r(i)\, \lambda_i - fc_r\right) \delta_r \; ip_r \qquad (4.4)$$

with

iis_r = investment in industrial sites 1995-2015 in region *r*
$\Delta\, e_r(i)$ = growth of employment in industry i 1995-2015 in region *r*
λ_i = industrial land use coefficient for industry i (ha per employee)
fc_r = industrial site free capacity in 1995 (ha) in region *r*
δ_r = regional deviation from national average industrial site size (national average=1)
ip_r = industrial site price in region *r*

Nature reserve development

In the BLS, national policy aimed at more nature reserve development is taken into account because it needs to be set against a shift in this policy in the RSS. Based on the EHS ("Main Ecological Structure", see Sijtsma & Strijker, 1995) additional land use for this purpose was calculated for both scenarios. In the RSS it is assumed that the shift towards the North gives room in the Rim City for more land extensive development of natural environment in new residential areas, like parks etc. In addition, extra residential land use in the North also gives rise to complementary natural environment development for these areas. The translation of these policy measures into additional government investment in the matrices $\dot{\mathbf{F}}_t$ for the BLS and their regional shifts in $\dot{\mathbf{F}}_t^*$ for the RSS is carried out on a detailed scale that does not need to be discussed here. See Sijtsma et al. (1996) for further details.

Agriculture

Large scale changes in land use cause substantial shifts in agricultural production. Compared to housing or business activities, the value of agriculture production per hectare is usually smaller. Therefore, changes in land use due to housing or business activities generally lead to a crowding out of agricultural production. In the RSS the total number of extra hectares needed in order to match the growth of residential land use, industrial sites and nature reserve development was simply subtracted from the agricultural land use. Agricultural land use, therefore, is treated as a residue. To determine the effect on agricultural production itself, an accepted methodology in agricultural economics is to look at the net financial yield per hectare of different crops and pasture for dairy farms (Sijtsma & Strijker 1995). The basic principle is that the crop with the lowest yield disappears first, then the crop with the second lowest yield, and so on. Crop rotation and other production constraints may alter this principle. For the RSS an ad hoc estimation is made for which parts of agricultural production in the North will have to give way for the extra land use needed for residential housing, industrial sites and natural reserve developments. The resulting shift in agricultural output is put into the model exogenously through adjusting the rows of agricultural final demand in $\dot{\mathbf{F}}_t^*$ accordingly.

The shift in agricultural land use is further determined by the assumed initial impulse of footloose production according to table 4.3, which is mainly related to horticulture. Less restrictive land use in northern horticulture will result in an extra agricultural land use of 2,000 ha in the North, mirrored by 1,500 less ha horticultural land use in the Rim City. Table 4.5 gives an overview of all land use effects in the RSS.

Table 4.5 Differential growth of land use in the RSS compared with the BLS

	Rim City		North	
	ha	%	ha	%
Industrial sites	-2400	-6	+3700	+30
Horticulture	-1500	-14	+2000	+284
Parks	+7000	+6	+6600	+5
Residential area	-9500	-11	+13900	+41
Recreation	-1500	-14	+1500	+26
Infrastructure	-4100	-7	+4600	+12
Agriculture	+12000	+3	-32300	-5
Total	0		0	

4.6.3 Traffic and congestion

The spatial reallocation of employment and population from the Rim City to the North was expected to have a considerable effect on traffic and congestion and on the need for additional infrastructure investment in both areas and both scenarios. To compute the potential savings on congestion a full traffic generation model should be applied, such as the LMS/NRM model developed by the Dutch Advisory Board for Traffic and Transportation (AVV, 1992). To compute the potential savings on infrastructure investment, again a full traffic generation model should be adopted, including the relationship between the level of investment and road capacity. In addition to this, a scheme is needed to translate lost travel time and extra fuel consumption due to congestion into costs, such as the scheme developed by NEA (1995).

For the BLS, a national run of the LMS/NRM model was available with a minimum and a maximum congestion estimate (HCG, 1995). A full national run of the RSS with the traffic generation model LMS/NRM was too expensive for the project budget, but results from a special northern version of the model could be obtained from Hofstra Verkeersadviseurs. In order to get an estimate of the national congestion for the RSS a simple own model has been used. First, a simultaneous regression model was developed explaining current utilization rates with traffic density and road capacity for the national network of 2,000 main road segments. This model has been estimated with a discrete component to explain the probability of congestion[24] and, if it occurs, a continuous component to explain the level of congestion (see Cragg, 1971). These data were made available by the AVV. Next, with these results a projection was made of the expected utilization rates in 2015 based on the traffic density and road capacity for each road segment in 2015 for the BLS. For the RSS, these results were adjusted upward for the North and downward for the Rim City proportional to the differential population growth in both regions. As described in Sijtsma et al. (1996) the congestion model was estimated as:

$$\ln KM \quad = \quad 5{,}687 + 0{,}010\ INT + 2{,}523\ IC \qquad (4.5)$$

with

KM = kilometre-minutes traffic jam
INT = traffic intensity (nr of vehicles per day)
IC = intensity/capacity rate (intensity/maximum intensity)

For the BLS, INT and IC were available for 2015 from the AVV. A detailed run of the traffic computer model of the AVV for the RSS was not possible. Therefore, for the RSS the traffic intensity INT by region was adjusted according to the differential population growth:

$$INT(RSS)_r \quad = \quad INT(BLS)_r \ \{ p(RSS)_r \ - \ p(BLS)_r \} \ / \ p(BLS)_r \qquad (4.6)$$

For both the BSL and the RSS the maximum road capacity was fixed for each road segment because there are no assumptions in the RSS about any regional change in infrastructure investment. Therefore, $IC(RSS)_r$ follows implicitly from (4.6).

With these predictions and the estimated regression model, it has been determined that the maximum estimate for the increase in congestion in the RSS over the period 1995-2015 reduces from +75% to +5% in the Rim City, while the increase in the North changes from +180% to +290% (see table 4.6). The latter increase seems enormous, but it relates to the 1995 situation when congestion in the North was almost absent. Table 4.6 also shows that the net congestion effect of the RSS for the Netherlands as a whole is substantial. The minimum estimates indicate that total national congestion in the RSS only rises with 2% over the period 1995-2015 compared with a predicted rise of 30% in the BLS.

[24] Congestion is measured in kilometre-minutes of traffic jams.

Table 4.6 Congestion change in both scenarios 1995-2015

	Rim City		North		Netherlands	
	BLS	RSS	BLS	RSS	BLS	RSS
Minimum estimate	+38%	- 6%	+ 29%	+120%	+30%	+ 2%
Maximum estimate	+75%	+ 5%	+180%	+290%	+55%	+11%

An important question is of course how the regional allocation of investment in road infrastructure should be adjusted to the projected regional shift in congestion in the RSS. The calculations in table 4.6 are largely carried out on the existing network in 1995 assuming an almost constant road capacity over the projection period[25]. The results for the Rim City in the RSS show nevertheless a modest growth of 5% (maximum estimate) or even a decline of 5% (minimum estimate) without any expansion of the road capacity. This suggest that for the RSS it would be reasonable to assume an infrastructure investment level for the Rim City that is sufficient to maintain existing road capacity, while reallocating resources toward the North for creating additional capacity.

Unfortunately, a direct relation between congestion levels and road investment allocation cannot be measured for many reasons. Instead, we had to adopt a very rough estimating procedure. First, from many different sources a minimum and a maximum estimate of the development of infrastructure by region in the BLS was constructed[26]. Next, for the RSS, a 100% increase of the infrastructure investment level was assumed for the North and a 50% reduction for the Rim City (see Sijtsma et al., 1996 for further details). The results have been feeded into the government investment column in the matrices $\dot{\mathbf{F}}_t$ for the BLS and the RSS. For infrastructure investment, therefore, the congestion estimates have only served as a rough guideline. The detailed results of table 4.6 have been used for the cost-benefit analysis (section 4.8).

Public transport

For public transportation networks no quantitative models were available for the RSS study. Instead, a qualitative assessment has been made of the possible net national efficiency gains of the RSS regarding public transportation. The most important benefits stem from lower average costs due to increasing passenger densities in the existing northern infrastructure, and rising economies of scale when the network of northern public transportation will need to be extended. The contrary effect of higher average cost in the Rim City is much smaller due to its already existing much higher densities

[25] The 2015 network has only been extended with new infrastructure that has already past the final implementation decision.

[26] For the period 1995-2000 some detailed investment programs were available. For the period 2000-2015, the minimum variant assumes a constant real investment level of 2000 and the maximum variant assumes an extrapolation of the growth rates for 1995-2000 (Sijtsma, op.cit., p. 64-70).

and economies of scale. The results are only used for the cost-benefit-analysis (see section 4.7) and do not play any role in SSDM2. See Sijtsma (1996, p. 68-70) for further details.

4.6.4 Emissions and health

For a complete cost-benefit analysis of the RSS, it was considered relevant to analyse its differential environmental effects, in particular for the northern region, which faces a substantial growth of population and economic activity. Contrary to the other model blocks, this analysis is only of a qualitative nature and its results are used for the cost-benefit analysis only. Therefore there is no direct link with the SSDM2 model.

Emissions of CO_2, SO_2 and other polluting elements are related to traffic intensity, energy use and the production levels of some specific industries. The environmental effects were measured with 10 different indicators. Seven of them relate to local and regional environmental issues such as acidification, eutrophication and dehydration. Most local environmental and health effects are clearly positive in the Rim City and, of course, negative in the North, but due to the much lower population density in the North compared to the Rim City, the net effect for the population of the Netherlands as a whole is positive. In particular, the national environmental effect of the regional shift in agriculture is positive because of the substantial reduction of sugar beat and potato cultivation in the North, which outweighs the additional effects of more horticulture that is less emission-intensive. The three other indicators relate to non-regional issues like global warming. Together they are only slightly negative due to higher energy use for domestic heating in the North, where the average temperature is lower than in the Rim City. See Sijtsma et al. (1996, p.71-76) for more details.

4.6.5 Macro results of the RSS

The RSS shifts in production, employment, population, labour supply and unemployment mentioned in the previous sections are recalculated in % growth rates in table 4.7. The difference between the two scenarios is the most pronounced in the population shift, but the shift in production is also substantial: a 0.5 %-point less growth in the Rim City leading to a 2%-point extra growth in the North. Northern unemployment is reduced from the high level of 9,1% in the BLS to the national level of 5,4% in the RSS in 2015.

Table 4.7 Comparison of macro results of the BLS and RSS 1995-2015

	Rim City	North	Netherlands
average annual growth %			
production			
BLS	2.8	2.2	2.9
RSS	2.3	4.2	2.9
employment			
BLS	0.8	0.6	0.9
RSS	0.4	2.3	0.9
population			
BLS	0.35	0.40	0.33
RSS	-0.42	2.33	0.33
labour supply			
BLS	0.80	0.60	0.81
RSS	0.41	2.02	0.81
absolute employment growth (x 1000)			
BLS	471	72	1169
RSS	221	322	1169
% unemployment 2015			
BLS	6.1	9.1	5.4
RSS	7.1	5.4	5.4

The projected rise of unemployment for the Rim City in the RSS does not take account of the expected positive macro-economic effects of the reduction of spatial scarcity and congestion, which was not included in the model. A tentative calculation showed that the 1%-point rise of unemployment in the Rim City could equally well be offset by a reduction of unemployment with 0,6 to 1,3%-point due to improved international competitiveness of Rim City activities (Sijtsma et al., 1996, p.35-36).

4.7 Costs-benefit analysis

A large part of the RSS study is devoted to a cost-benefit analysis (CBA) of the regional shift of all indicators involved. The theory and practice of CBA falls beyond the scope of this book. Therefore, the CBS results will only be briefly summarised here. Table 4.7 shows a summary of the regional and national costs and benefits of the RSS. In order to deal with the uncertainty inherent in any CBA, minimum and maximum estimates of costs and benefits have been made where most appropriate. All welfare effects, except for the entire last row, are based on the assumption that the growth of the national economy is not influenced by the RSS. This assumption is illustrated by the zero national unemployment effect in the first row of table 4.7.

Table 4.7 Costs and benefits of the RSS.
Values in billions of 1995 guilders discounted at 4% over the period 1995-2045

Welfare effects		Rim City	North	Netherlands
Less unemployment	(%-points)	-1.0%	+3.7%	0%
Fewer industrial sites				+0.4/+0.6
Lower industrial site costs		+1.6	-0.6	+1.0
Lower housing site development costs		+8.2	-7.8	+0.4
Green investments		-0.5	-0.9	-1.4
Greener living conditions		+9.9	+4.7	+14.6
Improvement in local service levels		0/-	++	0/+
Larger lots for migrants			+2/+4	+2/+4
Lower congestion costs*		+5.8/+9.3	-0.1/-0.4	+5.7/+8.9
[Less new transport infrastructure]		[+11/+28]	[-3/-7]	[+8/+21]
Less and cheaper public transport		+	0/+	+
Local environmental effects		+++++	---	++
Landscape variety improvement effect		+++	-	++
[More internationally mobile firms]**		[+22/+45]		[+22/+45]

* Alternative estimate, inclusion would be double counting.
** Not included because of tentative character.

First, regional unemployment rates will change due to changing employment opportunities and the partial shift in the regional labour force from the Rim City to the North. The unemployment rate increases slightly in the Rim City and decreases strongly in the North. It should be noted that this is primarily an improvement in national equity and not in national efficiency, unless people in the North are putting a higher value on their better labour market opportunities, which would more than compensate for the deterioration of the employment opportunities in the Rim City.

Next, fewer new industrial sites are needed nationally, while the costs of the new sites are lower than in the BLS. The extra housing site development costs for the 310,000 new dwellings in the North are also lower than those in the Rim City.

One important element of the CBA was a separate survey carried out among real estate mediators in the Rim City and the North in order to find out how larger residential plots and a greener living environment are valuated by people in both regions. These welfare effects were measured in terms of how much higher a price one would be willing to pay for the same house on a larger plot, in less densely build residential areas with more parks and within a shorter distance to recreation facilities and natural reserve areas (Sijtsma, op cit. chapter 5).

Residential living conditions for the existing population in the North and the Rim City improve for different reasons, especially due to extra investments in a green environment. In the Rim City these investments relate to areas close to existing urban areas that would have been used for residential purposes in the BLS, but which can now be allocated to recreational types of land use. In the North these investments relate to new recreational types of land use close to the new residential areas. However, the effect is lower than in the Rim City because of a negative welfare effect for the present population in the North, which in the RSS will live farther away from nature reserve areas due to the expanding housing land use in their surroundings (Sijtsma et al. 1996, p81). Table 4.7 shows the national welfare increase related to greener living conditions amount to a total of almost 15 billion guilders.

Migrants benefit primarily from better living conditions in the North as compared to the Rim City. This is especially true in view of the selective nature of the RSS and the selective migration induced by it. Potentially, some migrants might loose welfare because of longer distances to top-level urban amenities only found in the Rim City, but there will be few migrants to which these conditions apply. Note that the benefits derived from the larger lots available in the North are monetarised separately. Other cost and benefits for migrants are included in those for the new population at large in the North.

The change in the level of urban amenities is not monetarised. It is positive for both the rural areas and the urban centres in the North, since they will be able to increase the level of urban services due to their increased population base. In the Rim City the level of urban services will hardly be affected since the top-level services are based on the population of the Netherlands as a whole, whereas the population base for lower level urban services remains large enough to keep them intact, at worst at somewhat larger distances. The net national effect will, therefore, be positive.

The discounted net benefits of the overall reduction of congestion are estimated at about 6 to 9 billion guilders. The reduction of congestion costs has been calculated under the assumption that the planned transport infrastructure investments up till 2015 will also be carried through in the RSS. But by its nature, this scenario enables the Dutch central government to rearrange new investments in infrastructure in such a way that congestion costs will not change compared to the BLS. As mentioned, it has been approximated that a doubling of investment in infrastructure, i.e., roads, railways and other infrastructure for urban and regional public transport, in the North and a 50% reduction in the Rim City may keep congestion constant. The potential savings in infrastructure investments are shown between p.m. brackets as they may not be added to the savings in congestion cost in order to avoid double counting of alternative measures of benefits.

Environmental welfare gains are positive for the Rim City and negative for the North, but their national balance is slightly positive. There is not yet a standard methodology for capturing the effects on biodiversity and the landscape (Sijtsma & Strijker, 1995). In this study no detailed calculation has been made since it is likely that the overall effect of the loss of nature values due to less agricultural land on the one hand, and the gain of nature values due to greener residential neighbourhoods and more green recreational areas on the other hand, is rather small. For the same reason the effects on the landscape are only indicated qualitatively. In the RSS landscape deterioration is prevented in the Rim City, where these values are rapidly becoming scarce, resulting in a substantial positive effect. By contrast, the North will experience a negative effect due to the loss of open areas, but to a lesser extent since in the North these areas are not very scarce.

The final and largest welfare effect is the most speculative one. As a consequence of the reduction in congestion, the removal of the shortage of industrial sites and the improvement of its residential living conditions and lesser tension on the labour market, the Rim City will improve its international competitive position (see MEZ 1994, NEI 1994, for an analysis). Consequently, the Rim City might be able to attract more internationally mobile activities than in the BLS. The attempt to give a quantitative indication of this welfare effect in table 4.7 is based on the assumption that the Rim City would be able to recover internationally 5% to 10% of the economic activities ‘lost' to the North. It is to be noted again that the other costs and benefits shown in table 4.7 are estimated under the assumption that this highly uncertain but potentially large positive national effect will not occur, which is why it has been put between brackets.

Summarizing, a spatial deconcentration of economic activities and population in a growing economy, when carefully set up to avoid excessive transition costs and the loss of agglomeration economies, would clearly have positive national welfare effects. Most of the positive effects would be concentrated in the core region, whereas the peripheral region is expected to be subject to a more mixed distribution of both positive (economic) effects and negative (environmental) effects.

4.8 Conclusion

As has become clear from the previous sections, the RSS study was too complex to be carried out with a single integrated model. Many additional modular blocks had to be developed on an ad hoc base, using an eclectic approach and sometimes heavily constrained by limited time, resources and available data. The core SSDM2 model, however, proved very useful in keeping the consistency between the regional shifts in the key variables production, employment, investment and population. Its industrial detail enabled solid calculations for some important variables that needed specification by sector such as industrial site land use. Furthermore, as was the case with the Indonesian implementation of the SSDM model, its full interregional specification by sector provides implicit national results that can easily be checked and balanced with exogenous national projections. Its interregional structure moderates deconcentration effects that would result from a single-region model, because exogenous shifts to region N partly flow back to region R due to interregional spill over and feedback effects. The endogenous trade coefficients in SSDM2, however, reduce the build-in rigidity in interregional models with constant trade coefficients, in which dominant regions stay dominant, whatever exogenous shifts one assumes towards the periphery.

Thus, SSDM2 would have lead to more deconcentration in the Indonesian R2 scenario discussed in the previous chapter, but the two implementations are not comparable. In the RSS study, both regions N and R, although different in economic density, are highly developed economies and trade substitution effects are likely to occur. In Indonesia, peripheral regions are economically lagging far behind the dominant regions on Jawa, and many types of economic activities, such as manufacturing industries producing capital goods, simply do not exist in the periphery. It is then reasonable to assume that the dependence of the periphery on the centre will persist for longer periods of time.

The main weaknesses of SSDM2 are the absence of an integrated housing market and a direct link with a disaggregated traffic model. Regional differences in housing prices – for a province like Groningen almost 40% below the national level – are likely to diminish in the RSS, which would change the CBA, but this effect was not taken into account. A two-level model structure, disaggregating the macro shift in employment and population for the North as a whole to lower-level geographical locations, would enable an endogenous link with the AVV traffic model leading to more solid estimates of traffic flows and congestion along a detailed road network.

Recent studies of deconcentration effects between the North and the Rim City of a high-speed magnetic train from Schiphol-Amsterdam Airport to Groningen do precisely that (Knaap & Oosterhaven, 2000). Instead of large macro regions, the perspective moves towards individual agglomerations within the region, taking account of local housing markets and transportation infrastructure between them. It is this agglomeration modelling approach to which we will now turn in the next chapter.